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Housing Market in Israel: Is there a Bubble?

Summary: House prices in Israel have registered unprecedented growth rates in the last few years. At first glance, these hikes could be explained by the evolution of fundamentals such strong population growth and favourable macroeconomic conditions, i.e. low interest rates. However, further investigation is needed in order to explore whether there is a misalignment between house prices and their fundamentals. Firstly, this paper investigates the role of construction costs in the evolution of house prices. Secondly, this contribution decomposes the "price-to-rent" ratio into fundamentals, frictions and bubble episodes for a better understanding of the recent trends of the market.

Key words: House prices, Housing bubble, Cointegration, Israel.

JEL: C22, R31.

Over the past decade, an upsurge in house prices has been registered in the Israeli market, being the mentioned market the one that has exhibited the highest rate of growth of the OECD countries in the recent years. This trend has led to a situation characterised by a lack of affordable housing in areas that concentrate most of the employment opportunities across the country. Although some economists suggest that hikes in house prices have been driven mainly by demographic growth, low interest rates and positive expectations about the overall development of the economy; there is also some an on-going debate regarding the role that supply constraints have been playing in their evolution (Dotan Weiner and Franz Fuerst 2015; Moshe Dann 2016). In this context, economists might ask themselves the always-present query regarding price overvaluation: Is there a bubble episode in the market?

In order to bring some light on this issue, this contribution builds on Weiner and Fuerst (2015) by exploring a longer period (1995:Q1-2016:Q3) and analysing other explanatory determinants of house prices, such as the price of construction inputs. It needs to be mentioned that despite the interest that house price acceleration in Israel has attracted across the national media, the academic/scientific research on the topic is scarce. Thus, this contribution attempts to provide some further evidence that enhances the existing body of literature.

Focusing on the methodological approach, first of all, a house price equation is estimated by means of cointegration techniques. Failing in identifying a stable cointegrating relationship, there would be some evidence of a misalignment between house prices and their fundamentals. Thus, further analysis of the mentioned mis-

alignment will be required. In particular, a procedure based on Eloisa T. Glindro and Vic K. Delloro (2010) to decompose the "price-to-rent" ratio into fundamental, cyclical and bubble components will be applied. This mixed approach is used to explore a quarterly dataset that covers the period 1995:Q1-2016:Q3.

The remainder of this paper is organised as follows. After this introduction, Section 1 discusses extensively the notion of "bubble" and refers to the fundamentals of the housing market that will be explored. Section 2 presents the methodological approach that it is used for the empirical section of this paper, while Section 3 focuses on the data sources. Section 4 shows some factual information on the evolution of the housing market under consideration. Section 5 elaborates on our empirical results. Finally, some concluding remarks are provided in Section 6.

1. Theoretical Considerations

1.1 Understanding the Notion of "Bubble" in the Housing Market

The global financial crisis that occurred in 2007-2008 compelled economists to rethink about the notion of "housing". Housing assets cannot be considered exclusively as capital goods that suffers depreciation through time. Alternatively, they should be considered as a speculative asset similar to equities, as well as being priced according to the evolution of equity (Frederic S. Mishkin 2007). This alternative notion of housing assets has been also explored by Robert J. Shiller (2007a) who gives an important role to mass psychology and the expectations held by the public. More specifically, Shiller (2007a, b) defines a bubble as a process in which there is a feedback between the perception of the general public regarding the evolution of house prices and individuals' expectations about them. According to this mechanism, which Shiller (*op. cit.*) considers as a "social epidemic", public perceptions fuel a "sentimental" speculative interest, which finally, increases house prices and feeds this kind of "sentiment" among individuals, providing them with some evidence to maintain their beliefs. This process ends when house prices slow down and the relevant investment decision stops being profitable.

For a better understanding of the "psychology" behind the development of a bubble, we refer to several fallacies that are commonly extended and contribute to fuelling the development of expectations that are not in line with the fundamentals of the market (Jesús García-Montalvo 2003; The Economist 2003): (i) *house prices cannot fall under their present value*; this statement can be easily rejected in view of previous episodes of declining house prices;[1] (ii) *the scarcity of land provokes higher and quicker housing price appreciation*; the causality runs in the opposite direction, i.e. the price that a property developer is willing to pay for acquiring land is determined by the profits that s/he expects to obtain with the sale of those housing assets that s/he could build in this piece of land; (iii) *economic integration and the openness of markets drive house prices towards convergence among them*; further discussion of this argument is needed since in principle housing is not a good, a tradable good in

[1] For example, it is possible to mention the Japanese decline of almost 50% after the bust of the bubble in 1991. We may also refer to the situation of falling prices in the context of economic slowdown in Spain after the European Currency Crisis of 1992-1993.

international markets, i.e. its price is determined locally; (iv) *the existence of high transaction costs, related to the purchase and the sale of a dwelling, could avoid the development of bubbles in the market*; this argument can be questioned since it is most likely that sharp increases in the price of this type of asset are followed by a bust in the housing market than in the stock market (International Monetary Fund 2003); (v) *it is better to buy a property rather than rent it*; a surplus of dwelling in some markets, e.g. the German case, provides empirical evidence against this argument; and (vi) *low mortgage rates make this investment a cheaper one*; low mortgage rates permit the entrance in the market of more potential buyers, although those households who think that indebtedness is cheaper are thinking under "money illusion". Regarding the latter, Shiller (2007b) states that according to the elementary economic literature low long-term interest rates, i.e. low rates of discount for current values, would indicate high present asset valuations. Shiller (*op. cit.*) criticizes the theory of "money illusion", which justifies upward trends in asset prices under low inflation, as an inappropriate explanation. The rejection of the validity of this theory is based on the consideration that individuals understand the concept of inflation to push down nominal discount rates during declining-inflation episodes. However, they are not capable of noticing that they should not apply these low nominal rates to discount dividends into higher prices.

Another interesting aspect that needs to be discussed is the duration of the bubble episodes. Edward L. Glaeser, Joseph Gyourko, and Albert Saiz (2008) point to the supply inelasticity as the main explanatory variable of the duration of bubbles in the housing market. More specifically, a high elasticity of housing supply permits a rapid increase in the flow of dwelling assets that could be made available in the market in response to positive expectations and an actual increase in prices. In this context, the production of new properties during a bubble episode will lead to a sharp fall of house prices after the burst, with prices dropping below the existing level in the period prior to the bubble. However, it is unclear which markets will face the most negative impact of the "hangover" in the market. This is due to the fact that excess supply induces house price declines and their influence is lower in those areas, which exhibit higher housing supply elasticity. Glaeser, Gyourko, and Saiz (2008) also suggest that in those areas with elastic housing supply an increase in the optimism of those who participate in the housing market is tackled by a rapid increase in housing supply that induces the burst of the bubble since the capital gains related to housing sales are less than those which are expected. In contrast, in those areas where supply is inelastic fast and sharp hikes in house prices can be expected. This fact fuels the development of a bubble since the housing market "actors" are assuming adaptive expectations, which are eventually materialising.

Moving onto the different methods to identify a "bubble", a seminal contribution by Karl E. Case and Shiller (1989) suggests the utilisation of a survey to approximate home buyers' expectations. Case and Shiller (*op. cit.*) highlight that one of the "symptoms" that could suggest the presence of a bubble is a large share of purchases of real residential assets that respond to investment purposes instead of being a decision based on the value of the services that the asset provides. To make the point we refer to Case and Shiller (2003), who conduct a survey in the case of the

four metropolitan areas in the United States and find that almost 50% of the survey respondents bought their properties considering them as an investment.

Focusing on the quantitative approaches that have been proposed in the existing literature, this contribution concentrates on the analysis of the "price-to-rent" ratio, which can be interpreted along the lines of the financial concept "Price-to-Earnings" (PER) ratio. This measure, which compares the price of a share with its profit, suggests that investors' willingness to pay a higher price for an asset would be higher when a substantial flow of dividends is obtained. In the particular case of the housing market, the rationale behind the "price-to-rent" ratio is that high house prices relatively to rental prices will curb individuals' preference for homeownership. Thus, a high "price-to-rent" ratio that is maintained for a long period, could be the reflection of expectations of house prices and capital gains that are unrealistic and do not respond to the evolution of the market fundamentals. Nevertheless, an important problem in order to identify the presence of bubbles in the housing market, by analysing the mentioned ratio, relates to the lack of long-time series about prices and rents. This is so since it is possible that episodes in which house prices deviate from their fundamentals, i.e. the so-called "bubble condition" period, are accompanied by periods in which a slow and long correction takes place, which eventually avoids the burst. Some empirical evidence in favour of this argument is provided by Brent W. Ambrose, Piet Eichholtz, and Thies Lindenthal (2011) who identify this kind of episodes in the case of Amsterdam by analysing the period 1650-2005. More specifically, Ambrose, Eichholtz, and Lindenthal (2011) calculate the "price-to-rent" ratio and compare its value with the average for the whole period in order to identify those periods for which the current value, i.e. house prices, deviates from their fundamentals, which are captured by rents. This contribution highlights that house prices, instead of rents, are the channel through which the mispricing correction in this market takes place.[2]

1.2 Selected House Price Fundamentals

Before moving onto the analysis of the causes of house price overvaluation, some understanding of the drivers of the housing market under consideration is needed.

Drawing attention to the existing literature on the Israeli housing market, Moshe Bar-Nathan, Michael Beenstock, and Yoel Haitovsky (1998) highlight that house prices in Israel react strongly to demand shocks and price misalignments display considerable persistence. Doron Sayag (2012) focuses on the evolution of house prices at the regional level over the period 1999-2009 and applies the hedonic prices method to calculate price indices for 9 sub-regions. This contribution emphasises that different varying price trends across the areas under investigation emanates from differences in local unemployment rate, regional disposable household income, regional balance of migration, as well as other regional parameters such as the unsold inventory level and the number of housing starts. More specifically, Sayag (2012) reports the following findings. Firstly, a lack of a bubble in the north of the country since the

[2] See, also, Francisco Carballo-Cruz (2011) for some discussion of the dynamics of the housing market in the period prior to the collapse of the housing market in the case of Spain.

price increases in 2007 and subsequently were the adjustment of the market in response to the decline in price that occurred in the preceding years. Secondly, this contribution suggests that the likelihood of a bubble in the case of Tel Aviv and Jerusalem (where prices rose by 75% and 65% respectively) is much higher than in other areas of the countries.

We also refer to the analysis of house prices carried out by Weiner and Fuerst (2015) for the Israeli market. Weiner and Fuerst (*op. cit.*) concentrate on the period 1998:Q1-2013:Q4, and apply cointegration techniques to model house prices. In particular, their analysis focuses on exploring the role of the following set of fundamentals: rents, unemployment, stock prices, market volatility, mortgage rates, short-term interest rates, housing inventory-to-population and average real wage *per capita*. Focusing on the long run, their analysis considers that shortages of supply for housing and population growth are the main explanatory forces of rising prices in the market. Other factors such as mortgage rates and unemployment also reinforce this trend, while in the short-run cycles are driven by expectations of future price increases. This contribution also reports a "substitution" effect between the stock and housing markets. More specifically, Weiner and Fuerst (2015) reports that over the period 2007:Q2-2013:Q4 rental prices have increased by 19%, while house prices rose by 62% in real terms. Drawing attention to the period 2004-2007, this contribution does not find that the acceleration of economic activity that took place had a reflection in the housing market since a decline in house prices was registered. Weiner and Fuerst (2015) also conclude that house prices in Israel was 20% above their fundamentals over the period 2009-2013.

The present analysis of the fundamentals of the housing market in Israel builds on previous work undertaken by the authors to identify the main drivers of house prices across OECD countries. More specifically, Philip Arestis and Ana Rosa Gonzalez-Martinez (2016) proposed a conceptual framework based on James Poterba (1984) in which house prices are positively related to disposable income and bank credit, which is endogenously determined. Arestis and Gonzalez-Martinez (2016) also find that there is a negative relationship between house prices and mortgage rates, real residential investment, taxation over immovable property and current account imbalances. The mentioned house price equation is derived by assuming that in equilibrium housing supply and demand are equal.[3]

Bearing in mind these contributions, we propose to estimate the model described in Equation (1) in order to provide additional empirical evidence and check for the existence of other potential drivers:

$$\underset{\quad +}{P} = \underset{\quad +}{P}\ (\underset{\quad +}{Y^D},\ \underset{\quad -}{T^P},\ \underset{\quad +}{P^R},\ \underset{\quad +/-}{I^C},\ \underset{\quad -}{C^C}) \tag{1}$$

where P accounts for real house prices, Y^D for real disposable income, T^P for "taxation over property-to-house prices" ratio, P^R for the "price-to-rent" ratio, I^C for real

[3] See, also, Fernando A. de Oliveira Tavares, Elisabeth T. Pereira, and Antonio Carrizo Moreira (2014) for further discussion of the determinants of property values, along with some empirical evidence in the case of the Portuguese market.

construction inputs prices, and C^C for current account imbalances. The sign below a variable indicates the partial derivative of P with respect to that variable.

2. Methodology

This section focuses on our methodological approach. First of all, the econometric technique that has been used to estimate the house price equation that we propose is explained. Subsequently, the procedure developed by Glindro and Delloro (2010) to decompose house prices is presented.

2.1 Econometric Technique

For the purpose of this contribution, we apply the Autoregressive Distributed Lag (ARDL) bounds test for cointegration (M. Hashem Pesaran, Yongcheol Shin, and Richard J. Smith 2001), which is an appropriate estimation method in the case of small or finite sample sizes that include both trend stationary and first-difference stationary variables (Pesaran and Shin 1999; Paresh K. Narayan 2005).[4] In the context of the ARDL bounds test for cointegration, all the variables as endogenously determined. As shown in Equation (2), the ARDL bounds testing approach requires the estimation of the conditional Error Correction Model (ECM) shown in (2):

$$\Delta P_t = \beta_0 + \beta_1 P_{t-1} + \beta_2 X_{t-1} + \sum_{i=1}^{n} \beta_i \Delta P_{t-i} + \sum_{j=0}^{m} \beta_j \Delta X_{t-j} + \xi_t \quad (2)$$

where all the variables have the same meaning as in Equation (1), with the exemption of X, which is a vector that includes real disposable income, Y^D, "taxation over property-to-house prices" ratio, T^P, "price-to-rent" ratio, P^R, real construction inputs prices, I^C, and current account imbalances, C^C; β_0, which is the intercept of the regression; and ξ, which is a vector of the error white noise process. The estimation of the mentioned Error Correction Model is carried out by means of OLS.

Subsequently, the F-statistic and the Wald test (Damodar N. Gujarati and Dawn C. Porter 2010) are used to explore the existence of a cointegrating relationship between the variables mentioned above. In particular, Pesaran, Shin, and Smith (2001) proposed two sets of critical values: (a) the lower bound, which refers to the case in which all the time series are purely trend stationary, i.e. the time series are I(0); and (b) the upper bound that covers the case in which all the variables are first-difference stationary, i.e. the variables are I(1). Cointegration is found when the mentioned statistics present values above the upper bound. The appropriate lag length structure for the relevant conditional ECM is selected by using the Schwarz Bayesian

[4] We check for the order of integration of the time series that are included in our sample by means of the following tests: (a) the Augmented Dickey-Fuller (David A. Dickey and Wayne A. Fuller 1979, 1981) tests; (b) the Phillips-Perron (Peter C. B. Phillips and Pierre Perron 1988) test; (c) the GLS-based Dickey-Fuller (Charles R. Nelson and Charles Plosser 1982) test; (d) the Kwiatkowski-Phillips-Schmidt-Shin (Denis Kwiatkowski et al. 1992) test; and (e) the Lee and Strazicich's (Junsoo Lee and Mark Strazicich 2003) unit root test, with two endogenous breaks. The results of these tests are not reported but they are available from the authors upon request.

Information Criterion (SBC). More specifically, a maximum lag length of 4 periods has been assumed when estimating the relevant model.[5]

In order to validate our econometric results, the following tests are applied: (a) a test based on the regression of squared residuals, which checks for the lack of heteroskedasticity; (b) the Breusch-Godfrey Serial Correlation LM statistic (Leslie G. Godfrey 1978; Trevor S. Breusch 1979), which tests for the absence of autocorrelation; (c) a normality test, which relies on the kurtosis and skewness of the residuals; and (d) the Cumulative Sum Control (CUSUM) test and the CUSUM of squares test, to check the stability of the estimated parameters (Robert L. Brown, James Durbin, and James M. Evans 1975).[6]

Microfit 4.1 is the specialised software that has been used to estimate the conditional ECM model described in Equation (2).

2.2 Decomposing House Prices

For a better understanding of the dynamics of the housing market in Israel, our contribution explores the existence of a potential misalignment between house prices and their fundamentals. If price overvaluation is found, further analysis is carried out in order to study whether the mentioned misalignment responds to a short-run imbalance between supply and demand for housing or is driven by home buyers' speculation.

In other words, house price overvaluation results from the interaction of two forces, the cyclical and "bubble" components. The cyclical component accounts for the proportion of house price overvaluation that is caused by imbalances between demand and supply of housing, while the "bubble" component reflects the proportion of house price overvaluation that is due to investors' speculation.

In particular, we apply the procedure developed by Glindro and Delloro (2010). Essentially, this three-step approach permits us to decompose house price into three elements: fundamental, cyclical and bubble components. To begin with, long-run price overvaluation, λ^o_t, is calculated by subtracting the long-run trend price, λ^l_t, to the actual house price variable, λ_t, as reported in Formula (4):

$$\lambda^o_t = \lambda_t - \lambda^l_t. \tag{4}$$

Then, the proportion of house prices overvaluation that is due to the cyclical component, i.e. short-run frictions, λ^s is computed as shown in Expression (5):

$$\lambda^s_t = (\lambda_{t-1} + \lambda^c_t) - \lambda^l_t \tag{5}$$

where $(\lambda_{t-1} + \lambda^c_t)$ is the short-run price, i.e. the short-run friction; λ^c_t is the short-run cyclical component, and λ^l_t refers to the long-run trend price.

Finally, we proceed to compute the bubble component by subtracting the variables calculated in Equations (4) and (5). In other words, the bubble component is

[5] A preliminary estimation exercise using a higher number of lag periods did not reveal significant results.

[6] The results of the CUSUM and the CUSUM of squares tests are not reported but they can be obtained from the authors upon request.

compute as the difference between housing price overvaluation and the proportion of price overvaluation that is caused by the short-run frictions. The relevant calculation is displayed in Formula (6):

$$\lambda_t^b = \lambda_t^o - \lambda_t^s \tag{6}$$

where all the symbols have the same meaning as before, with the exception of $\lambda^b{}_t$, that accounts for the bubble component.

Therefore, house prices can be computed by summing up house prices in *t-1*, and their cyclical and bubble components in the current period, *t*, as explained in Formula (7):

$$\lambda_t = \lambda_{t-1} + \lambda_t^c + \lambda_t^b \tag{7}$$

where the variables are defined as in Equation (4-6).

The original approach by Glindro and Delloro (2010) applies the filtering technique proposed by Rudolf E. Kalman (1960) to compute the long-run trend house price. However, as discussed in Arestis, Gonzalez-Martinez, and Jia Lu-Kui (Forthcoming), we modify Glindro and Delloro's (*op. cit.*) procedure and employ the Band Pass filter (Lawrence J. Christiano and Terry J. Fitzgerald 2003) filter. This is so since the Christiano and Fitzgerald's (2003) filter is expected to perform better in the case of time series whose behaviour can be described as a "random-walk" process.

It needs to be noted that our analysis focuses on the "price-to-rent" ratio instead of decomposing house prices. This is so in an attempt to provide additional evidence which goes beyond the existing literature. As mentioned above, Weiner and Fuerst (2015) analyse the contribution of different explanatory factors to the house price misalignment that the authors report in the Israeli market, e.g. unemployment, wages, rents, stock market prices, etc. However, this contribution does not decompose the "price-to-rent" ratio.

3. Data

For the purpose of this contribution, we utilise quarterly data for Israel that spans the period 1995:Q1-2016:Q3. Although there are quarterly time series on house prices and real disposable income that go back to the 1970s, the length of our sample is determined by the availability of data on construction inputs prices and the "price-to-rent" ratio.

The main data database that has been used is the *International House Price Database* maintained by the Globalization and Monetary Policy Institute of the Federal Reserve Bank of Dallas (Adrienne Mack and Enrique Martínez-García 2011). The mentioned database contains quarterly data on real house prices and personal disposable income for the period 1975:Q1-2016:Q3.[7]

Moreover, quarterly data on the "price-to-rent" ratio was obtained from the *OECD Analytical House Prices Indicators Database*. The *OECD Key Short-Term*

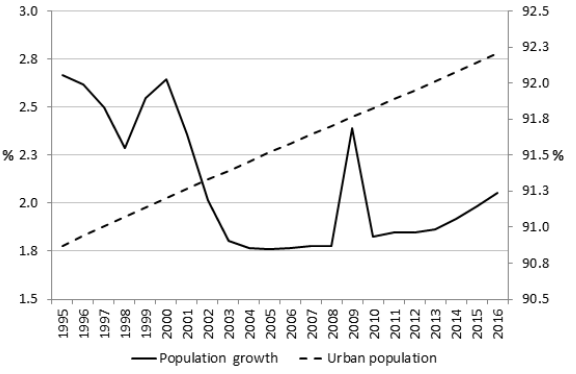
[7] https://www.dallasfed.org/institute/houseprice/#tab1.

Indicators database is also the source for current account (as percentage of GDP) time series, while the database "Revenue statistics" is the source for data on taxation over immovable property.[8] Monthly data on prices of construction inputs is available at the Bank of Israel as part of the indicators on *Real Economic Activity*.[9] Quarterly time series were produced by taking the average value for each quarter.

Apart from that, some additional data was required for Section 4. In particular, the *World Development Indicators* database, which is published by the World Bank, was consulted in order to collate data on total and urban population, while the *Federal Reserve Bank of Dallas database* was the source for the exuberance indicators.[10]

4. Factual Information

For a better understanding of the dynamics of the housing market in Israel, we present some key indicators for the period under consideration. Figure 1 displays the rate of growth of the population, along with the share of urban population (as percentage of total population) over the period 1995-2016. In particular, Figure 1 shows that the slowdown in the growth population has been accompanied by a slightly increase in the share of population who lives in urban agglomerations. At first glance, the increase in the share of urban population over total population does not seem to be an important driver of rising house prices in Israel, since over the last decade the mentioned proportion increased by less than 2 per cent.



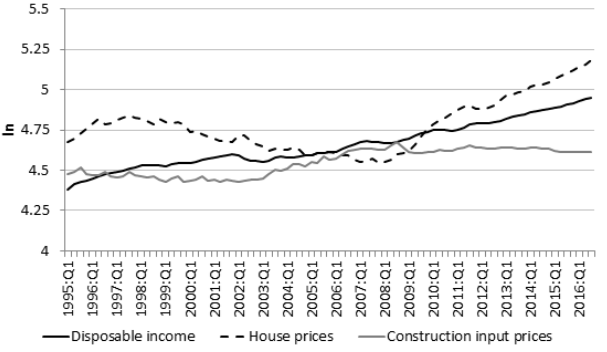
Source: Authors' calculation based on World Bank.

Figure 1 Population Indicators (1995-2016)

Figure 2 reports real disposable income, real house and construction inputs prices over the past decade. As shown in the figure, disposable income has been growing steadily since 1995. Drawing attention to construction input prices, Figure 2 shows a slight decrease over the period 1995-2003; that was followed by a period of

[8] http://stats.oecd.org/.
[9] https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE_PRICES#; http://www.boi.org.il/en/DataAndStatistics/Pages/MainPage.aspx?Level=3&Sid=14&SubjectType=2.
[10] http://databank.worldbank.org/data/home.aspx; https://www.dallasfed.org/institute/houseprice/.

growth that ended in 2008. Over the past eight years the construction input prices has been maintained stable, while house prices have registered a sharp increase. This finding could indicate a misalignment between house prices and their fundamentals. This is so since the final price of the assets, i.e. housing, seems to be (at least partly) "disconnected" from their production costs.



Source: Authors' calculation based on Federal Reserve Bank of Dallas.

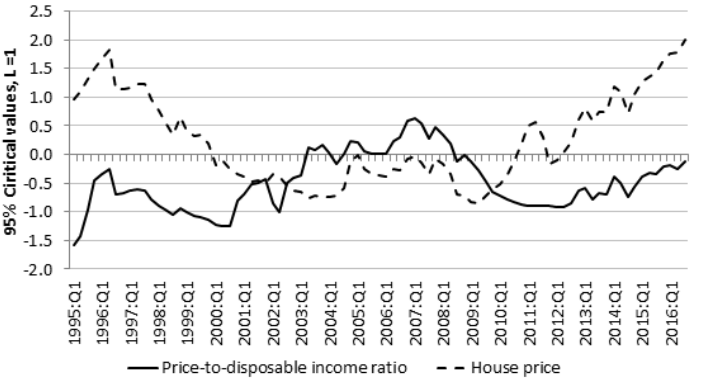
Figure 2 Disposable Income, House Prices and Construction Input Prices (1995:Q1-2016:Q3)

As reported by the Ministry of Construction and Housing (2016), house prices have been growing at a faster pace than rents (75 and 23 per cent between 2008 and 2015 respectively). Figure 3 presents the evolution of the "price-to-rent" ratio since 1995. In particular, a sharp increase in the mentioned ratio has been observed since 2003, being particularly intense in the last eight years. Although it is not reported in the figure, the "price-to-rent" ratio has grown according to a quadratic trend over the whole period (R2 = 0.93). Figure 3 shows how lately the "price-to-rent" ratio has been well above its long-term value. In line with the existing literature (Edward E. Leamer 2002; Jason Bram 2012), this fact could be considered as preliminary evidence in favour of the existence of a bubble episode in the housing market in Israel.

Source: Authors' elaboration based on Federal Reserve Bank of Dallas.

Figure 3 "Price-to-Rent" Ratio (1995:Q1-2016:Q3)

Finally, Figure 4 presents the exuberance indicators calculated by Efthymios Pavlidis et al. (2016). Pavlidis et al. (2016) apply an extension of the test developed by Phillips, Shuping Shi, and Jun Yu (2015) to identify periods of exuberance. More specifically, Pavlidis et al. (*op. cit.*) identify periods of exuberance in most of the housing markets that are included in the International House Price database. These indicators identify an "exuberant" or "explosive" pattern when prices deviate from their fundamentals.



Source: Authors' calculation based on Federal Reserve Bank of Dallas.

Figure 4 Exuberance Indicators (1995:Q1-2016:Q3)

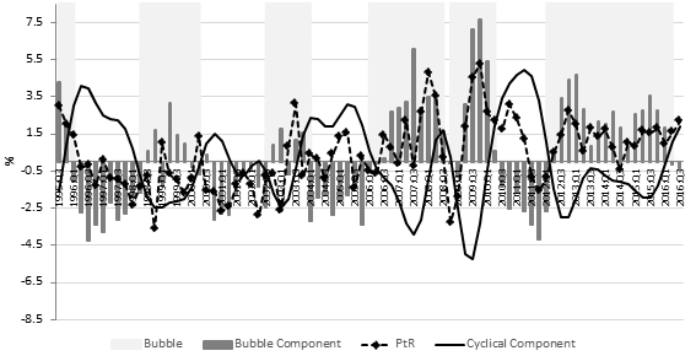
5. Empirical Results

The results estimated by means of the ARDL bounds-testing approach does not permit us to identify a stable cointegrating relationship between house prices and the set of explanatory variables under consideration. More specifically, house prices seem to be cointegrated with disposable income over the period 1995:Q1-2008:Q1, although this cointegrating relationship ceases if the period of analysis is extended. Other potential relationships that include additional explanatory factors were estimated, and subsequently, rejected since the signs of the relevant variables were unstable and not in line with the existing literature.

The lack of cointegration among house prices and their fundamentals could be indicating the existence of a "bubble" episode (Campbell and Shiller 1987; Bala Arshanapalli and William Nelson 2008).[11] These results provide a justification for conducting further analysis by applying the Glindro and Delloro (2010) procedure in order to identify whether the lack of co-movement between house prices and the fundamentals of the market is due to short-run frictions or home buyers' speculation.

[11] Arshanapalli and Nelson (2008) suggest that a relationship that suddenly becomes unstable during a period of rising house prices is consistent with a "bubble" episode. More specifically, Arshanapalli and Nelson (*op. cit.*) indicate that if there is a bubble in *t*, economists should be able to find variables that are cointegrated with house prices before *t*, although there could be cointegrating relationship from *t* onwards.

Figure 5 displays the rate of growth of the "price-to-rent" ratio in Israel over the period 1995:Q3-2016:Q3. This figure also reports the contribution of the bubble and cyclical components to the "price-to-rent" ratio. The "shaded" areas indicate the periods in which the "bubble" component was stronger than the cyclical component.



Source: Authors' elaboration.

Figure 5 "Price-to-Rent" Ratio Decomposition

As shown in Figure 5, the "price-to-rent" ratio has been driven by the evolution of the bubble component in the following periods: (i) 1995:Q3-1995:Q4; (ii) 1998:Q3-2000:Q1; (iii) 2002:Q4-2003:Q4; (iv) 2006:Q2-2008:Q2; (v) 2009:Q1-2010:Q1; and (vi) 2012:Q2-2016:Q1.

These empirical findings need to be further discussed in the context of a market in which a systematic shortage of supply has been identified since 2008. More specifically, these results reveal that the evolution of the market has been characterised by the alternation between periods of short-run frictions and investors' speculations in a context of sustained and strong house price hikes in which the market did not collapse so far. These facts could be considered somehow consistent with the existence of a "rational" bubble in the market (Glaeser, Gyourko, and Saiz 2008) since the supply for housing in the Israeli market is somehow given. Following the typology proposed by Paul Hilbers et al. (2008), we could be witnessing the development of an "intrinsic" bubble, which could be correlated with the evolution of the fundamentals, e.g. insufficient number of housing starts. To make the point, we refer to Ministry of Construction and Housing (2016) that estimates annual households formation at 50,000 units, while building starts over the past decade were 32,500 on average. Thus, further research is needed to assess whether such a potential correlation exits and confirm this preliminary evidence.

6. Summary and Conclusions

This contribution aims at investigating a potential misalignment between house prices and their fundamentals in the case of the Israeli housing market over the period 1995:Q1-2016:Q3. Firstly, this piece of research explores the existence of a linear cointegrating relationship between house prices and real disposable income,

"taxation over property-to-house prices" ratio, "price-to-rent" ratio, construction inputs prices and current account imbalances. The lack of a stable cointegrating relationship over the period under investigation suggests a potential misalignment in the market. Secondly, this paper applies a decomposition procedure based on Glindro and Delloro (2010) to decompose the "price-to-rent" ratio into fundamental, cyclical and "bubble" component. In particular, this analysis reveals that the bubble component, i.e. investors' speculation, has been playing a major role in the dynamics of the housing market since 2012, although in the second and third quarter of the 2016 cyclical fluctuations have become the dominant force. Thus, this investigation finds the evolution of house prices in Israel somehow worrisome in view of the strong role played recently by investors' speculation in a market where a significant shortage of dwelling has been identified. The combination of these two factors could lead to the development of a bubble in the market preceded by a sustained and long booming period.

However, these results should be explored further and supplemented by additional research at regional level due to the existing discrepancies in terms of house and rental prices, as well as local fundamentals across the different regions. Additionally, the existence of no-linear cointegrating relationships is also another "avenue" that future research should follow.

Nevertheless, Israeli policy-makers should monitor closely the evolution of the housing market since the current positive macroeconomic environment combined with a strong preference for housing could favour the development of an explosive pattern in the market. In this context, macroprudential policy and an appropriate risk assessment of potential borrowers will be more beneficial than conventional monetary instruments, such as raising the basic interest rate. At the same time that any interventions to increase supply for housing, as well as increasing the productive capacity of the construction industry, should be encouraged in an attempt to curb house prices.

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